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NORTHERN DISTRIBUTIONAL LIMITS OF THE MEXICAN WILLOW OAK (*QUERCUS VIMINEA*) IN ARIZONA, SONORA, AND CHIHUAHUA

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ABSTRACT

Observations of the Sierra Madrean oak *Quercus viminea* in ten Sky Island mountain ranges 15 to 85 km south of the Arizona and New Mexico border in Sonora and Chihuahua help define the northern and western limits of its distribution. We also discovered it in the Patagonia Mountains of southern Arizona as far north as 15.3 km from Sonora. It is sympatric with the closely related *Q. emoryi*, with which it introgresses.

KEY WORDS: *Quercus viminea, Quercus emoryi,* Fagaceae, Sonora flora, Arizona flora.

Quercus viminea Trel. occurs on the western slope of the Sierra Madre Occidental from its southern terminus in central Jalisco north to western Chihuahua and eastern Sonora and into the Sky Island mountain ranges of northeastern Sonora and southern Arizona, a north-south range of about 1450 kilometers (Nixon 1993; Felger et al. 2001; Spellenberg 2001).

Since about 1990, *Quercus viminea* has been collected during extensive botanical explorations in the Sierra Madre Occidental in Sonora as part of an effort to document the flora of the Río Mayo Region, including the Yécora area (Martin et al. 1998; Van Devender & Reina-G., unpubl. data). The Madrean Archipelago is the area of Sky Island mountain ranges between the northern terminus of the Sierra Madre Occidental in eastern Sonora and western Chihuahua and the Mogollon Rim in Arizona and southwestern New Mexico.

Since 2009, the Madrean Archipelago Biodiversity Assessment (MABA) project of Sky Island Alliance has surveyed six isolated Sky Islands in northeastern Sonora. Since the early 2000s, Aaron D. Flesch, Sky Jacobs, and other field ornithologists recorded forest trees in many Sonoran Sky Islands during surveys of breeding birds in the Madrean Archipelago in Sonora. Between 2009

and 2012, Flesch and his associates at the University of Arizona and University of Montana surveyed birds and vegetation in 26 Sky Islands in Sonora and Chihuahua and recorded *Quercus viminea* in many new localities. Detailed information for herbarium specimens and observations are available online at the Madrean Archipelago Biodiversity Assessment (MABA, madrean.org) and the linked Southwest Environmental Information Network (SEINet, swbiodiversity.org/seinet/) databases. Here we report noteworthy observations of *Quercus viminea* that help define the northern and western limits of its distribution.

Quercus viminea has large, thin, flexible leaves that are erect to widely spreading, spreading, or even pendent in the southern portion of the range, as illustrated in González-Villareal (1986) and Trelease (1924, as *Q. bolanyosensis* Trel.). In the Sonoran Sky Islands, leaf length is reduced but blades are still thin, flexible, and rather lax, often held vertically (Martin et al. 1998), as illustrated in Trelease (1924) and Felger et al. (2001). In northeastern Sonora, *Q. viminea* has thin, flexible leaves characteristic of *Q. viminea*, but many trees have stiffer leaves that are proportionately wider relative to length, often more spreading, and with subtly more prominent venation beneath, suggesting introgression with *Q. emoryi* (Felger et al. 2001; Spellenberg 2001). Acorns are said to be annual on *Q. emoryi* and biennial (maturing at end of second season) on *Q. viminea*; that this applies in the USA is not documented (Jensen 1997). Our recently collected plants documenting *Q. viminea* in Arizona did not bear mature acorns; most were completely vegetative.

Quercus viminea occurs south of the Arizona border in the Sierras los Ajos (48.0 km S), Avispas (15.2 km S), Azul (66.0 km S), Cíbuta (30.8 km S), La Madera (76.0 km S), El Pinito (33.7 km S), La Púrica (75.6 km S), and El Tigre (84.9 km S) in Sonora. It also occurs in the Sierra San Luis, Sonora, and the Sierra El Púlpito, Chihuahua, 15.6 and 64.1 kilometers south of the New Mexico border (Fig. 1). In Trees of Sonora, Mexico, Felger et al. (2001) reported a 1923 collection from Red Mountain south-southwest [really southeast] of Patagonia, Arizona, 18.9 km north of the USA-Mexico border. The specimen was recalled to have been seen by one of us (RS), but label information and herbarium of deposition had been lost. In April 2013 as part of a MABA Expedition to the Patagonia Mountains west of Nogales, Arizona, we documented *Q. viminea* near Red Hill (7.4 km N of USA-Mexico border) and in Humboldt Canyon (14.6 to 15.3 km N). These localities are 7.3 and 15.2 km, respectively, north of the international border. Surveys at Red Mountain in May 2009 only revealed *Q. emoryi*, with possible introgression with *Q. viminea* in a few individuals.

These collections and observations document the distribution of a Sierra Madrean species in the Madrean Archipelago of northeastern Sonora, northwestern Chihuahua, and southern Arizona, and confirming its presence and persistence in Arizona previously based on a single observation made 90 years ago. Botanists should keep an eye out for this interesting species in borderland ranges of Arizona and New Mexico hiding among *Q. emoryi*.

Specimens and observations. **USA**. **Arizona**. Santa Cruz Co.: Santa Cruz, near Red Hill, 15.4 km (by air) S of Patagonia, Coronado National Forest, Patagonia Mountains, 31.40194° N, 110.74000° W, 1756 m, solitary 9 m tall tree, rounded crown, dark bark in oak woodland on rocky mountainside, 27 Apr 2013, *Reina-G. 2013-71, Van Devender, Dimmitt,* and *Ferguson* (ARIZ, ASU, MEXU, NMC, USON; Fig. 2); near Humboldt Mine, Humboldt Canyon, tributary of Alum Gulch, 8.5 km (by air) SSE of Patagonia, Coronado National Forest, Patagonia Mountains, 31.46611° N, 110.73667° W, 1518 m, uncommon 6 m tall tree in red rocky canyon bottom, [the proportionally broad leaves suggest introgression with *Quercus emoryi*], 28 Apr 2013, *Reina-G. 2013-73, 2013-74, Van Devender, Dimmitt,* and *Ferguson* (ARIZ, NMC; Fig. 3 and 4); near Humboldt Mine, Humboldt Canyon, tributary of Alum Gulch, 7.9 km (by air) SSE of Patagonia, Coronado National Forest,

Figure 1. *Quercus viminea* localities in the Patagonia Mountains, Arizona, and in Sonora and Chihuahua.

Patagonia Mountains, 31.47111° N, 110.73333° W, 1479 m, 4 m tall tree in red rocky canyon bottom, [the proportionally broad leaves suggest introgression with *Quercus emoryi*], 28 Apr 2013, *Reina-G. 013-81, Van Devender, Dimmitt,* and *Ferguson* (ARIZ, NMC, TEX). **MEXICO. Chihuahua.** Mpio. de Janos. 30.7 km NNE of Bavispe, Sierra El Púlpito, 30.752735° N -108.873178° W, 1734 m, oak woodland, 10 Jun 2012, *Hilchy* (MABA observation). **Sonora.** Mpio. de Agua Prieta. Rancho El Pinito, Arroyo Cajón Bonito, 56.5 km (by air) ESE of Agua Prieta, Cuenca Los Ojos Foundation, Sierra San Luis, 31.190556° N, 108.940833° W, 1432 m, uncommon in sycamore-Arizona cypress-oak canyon riparian forest, 23 Sep 2009, *Van Devender 2009-1496, Reina-G., Roll,* and *Rose* (ARIZ); Mpio. de Bacoáchi. 30.8 km NNW of Nacozari de García, Sierra la Púrica, Ajos-Bavispe Forest Reserve, 30.646337° N, 109.774625° W, 1581 m, 20 May 2010, *Hilchy* (MABA observation); Mpio. de Bavispe. 26.8 km (by air) WNW of Bavispe, Sierra El Tigre, 30.566593° N, 109.202252° W, 2013

m, *Flesch* and *González-Sánchez* (MABA observation); Mpio. de Fronteras. Cañón Hoya Obscura, ca, 1.3 km (by air) WNW of Cerro navada, 39.0 km (by air) ESE of Cananea, Sierra de los Ajos, 30.8977° N, 109.90443° W, 1920 m, 16 Jun 2010, *Flesch* (MABA observation); Mpio. de Magdalena de Kino. 19.2 km (by air) E of Magdalena de Kino, Sierra de la Madera, 30.644014° N, -110.750556° W, elev. 1936 m, 19 Jun 2009, *Jacobs* and *Flesch* (MABA observation); Mpio. de Ímuris. 27.8 km (by air) E of Ímuris, Sierra Azul, 30.766940° N -110.563177° W, elev. 1641 m, 31 May 2010, *Flesch* and *González-Sánchez* (MABA observation); Mpio. de Nogales. near Rancho La Cabañita, 7.9 km NW of Rancho El Diamante (on road to Sáric from MEX 15), ca. 15 km (by air) SW of Nogales, Sierra Las Avispas, 31.196944° N, 111.096111° W, 1234 m, uncommon 8 m tall tree with dark bark with *Quercus arizonica, Q. emoryi,* and *Q. oblongifolia,* [leaf shape, rigidity, and prominence of venation on abaxial side of leaves suggest introgression with *Q. emoryi*], 17 Aug 2004, *Van Devender 2004-884, Reina-G.,* and *Merlin* (ARIZ, NMC); Mpio. de Nogales. 11.3 km W of MEX 15 on road to Sáric, 17.1 km (by air) SSW of Nogales, Sierra las Avispas, 31.14305556° N, 111.0613889° W, 1475 m, locally common 5–7 m tall tree among on rocky hillside in oak woodland with typical *Quercus emoryi* with short, toothed leaves, [introgressed with *Q. emoryi*], 12 Sep 2002, *Van Devender 2002-723, Reina-G., Sánchez-E., Moreno-M.,* and *Liu* (NMC); Mpio. de Nogales. Poso del Santo Niño, Rancho La Alameda, 6 km (by air) W of Cíbuta, Arroyo El Madroño, Sierra Cíbuta (= S. Guacomea), 31.05611° N, 110.96837° W, 1472 m, occasional 7 m tall tree in oak woodland with *Quercus emoryi*, 5 April 2005, *Reina-G. 2005-561, Van Devender,* and *Ruiz-C.* (NMC); Mpio. de Nogales. 17.0 km (by air) ESE of Cíbuta, 35.4 km (by air) SSE of Nogales, Sierra Pinito, 31.028206° N, 110.725332° W, 1615 m, dominant tree in oak woodland, 17 Jul 2007, *Jacobs* and *Flesch* (MABA observation).

Figure 2. *Quercus viminea* in Humboldt Canyon in the Patagonia Mountains. Photo by T.R. Van Devender, April 2013.

Figure 3. Leaves of *Quercus viminea* from near Red Hill, Patagonia Mountains, Arizona. Photo by T.R. Van Devender, April 2013.

Figure 4. *Quercus viminea* in Humboldt Canyon in the Patagonia Mountains. Leaves showing *Q. emoryi introgression.* Photo by T.R. Van Devender, April 2013.

Figure 5. *Quercus viminea* in Humboldt Canyon in the Patagonia Mountains. Upper and lower surfaces of leaves. Photos by Mark A. Dimmitt, April 2013.

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